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TITLE: Abnormal oil pressure reduction determination device for vehicle transmission

Abstract Paragraph:
An abnormal oil pressure reduction determining device has an oil pressure sensor which detects a real oil pressure, a sensor which detects a vehicle running state, and a controller which sets an oil pressure command value for an oil pressure control mechanism. The controller computes the lower limiting oil pressure which is possible in the present vehicle running state, and when the real oil pressure is less than this lower limiting oil pressure and the pressure difference between the real oil pressure and oil pressure command value exceeds a reference value, determines that there is an abnormal pressure reduction due to a fault in the oil pressure control mechanism. Even if the oil pressure of the transmission has dropped abnormally due to some reason, the abnormal oil pressure reduction determining device determines the situation without fail.

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Summary of Invention Paragraph:
[0001] This invention relates to an abnormal oil pressure reduction (drop) determination device which can be used for a vehicle transmission controlled by oil pressure.

Summary of Invention Paragraph:
[0004] It is therefore an object of this invention to provide an abnormal oil pressure reduction determination device for a vehicle transmission which can determine the situation where the oil pressure of the transmission is decreased abnormally for some reason.

Summary of Invention Paragraph:
[0005] In order to achieve the above object, this invention provides an abnormal oil pressure reduction determination device for use with a transmission of a vehicle, the transmission having an oil pressure control mechanism which performs speed change control using oil pressure. The abnormal oil pressure reduction determination device comprises an oil pressure sensor which detects a real oil pressure, a sensor which detects a vehicle running state, and a microcomputer-based controller which sets an oil pressure command value for the oil pressure control mechanism. The controller functions to compute a lower limiting oil pressure which is possible in the present vehicle running state, compare the real oil pressure with the lower limiting oil pressure, compare the real oil pressure with the oil pressure command value, and when the real oil pressure is less than the lower limiting oil pressure and when a pressure difference between the real oil pressure and oil pressure command value exceeds a reference value, determine that there is an abnormal oil pressure reduction due to a fault in the oil pressure control mechanism.

Brief Description of Drawings Paragraph:
[0007] FIG. 1 is a schematic view showing an abnormal oil pressure reduction determination device for a vehicle transmission.

Brief Description of Drawings Paragraph:
[0009] FIG. 3 is a block diagram showing the control performed by the CVT controller of the abnormal oil pressure reduction determination device.

Brief Description of Drawings Paragraph:
[0010] FIG. 4 is a flowchart showing a control routine performed by the CVT controller of the abnormal oil pressure reduction determination device.

Brief Description of Drawings Paragraph:
[0012] FIG. 6 is a graph describing a determination of a continuous abnormal oil pressure reduction. FIG. 6A shows a time variation of a difference D1 between an oil pressure command value and a real oil pressure. FIG. 6B shows a time variation of an accelerator pedal stroke (throttle valve opening) (TVO). FIG. 6C shows a time variation of a vehicle speed (Vsp). FIG. 6D shows a time variation of a timer value for measuring the duration of an abnormal oil pressure reduction.

Brief Description of Drawings Paragraph:
[0013] FIG. 7 is a graph describing an abnormal oil pressure reduction determination.

Brief Description of Drawings Paragraph:
[0014] FIG. 8 is a graph describing the reproducibility determination for the abnormal oil pressure reduction, which expands FIG. 7 to earlier and later timings.

Detail Description Paragraph:
[0015] FIG. 1 shows one embodiment of a determination device for determining an abnormal oil pressure reduction of a vehicle transmission according to this invention.

Detail Description Paragraph:
[0021] Signals from an inhibitor switch 23, accelerator stroke amount sensor 24, oil temperature sensor 25, primary pulley rotation speed sensor 26, secondary pulley rotation speed sensor 27, oil pressure sensor 28, vehicle-dynamics-control (VDC) unit 29, engine rotation speed sensor 37 and an input torque signal (engine torque signal) from an engine controller 21 are inputted into the CVT controller 20. Based on these signals, the CVT controller 20 determines a speed ratio and contact frictional force. Herein, the speed ratio is a value obtained by dividing the effective radius of the secondary pulley 12 by the effective radius of the primary pulley 11, and is identical to the pulley ratio. The CVT controller 20 transmits a command to the oil pressure control mechanism 30 to control the transmission 10, and determines whether or not the oil pressure of the transmission dropped abnormally. The specific details of this determination are described later.

Detail Description Paragraph:
[0022] The VDC unit 29 and the engine controller 21 are microcomputer-based controllers. Also, the CVT controller 20 included in the abnormal oil pressure reduction determination device comprises a microcomputer which is provided with a central processing unit (CPU) which executes programs, read-only memory (ROM) which stores programs and data, random access memory (RAM) which stores the computation result of the CPU and acquired data temporarily, one or more timers for measuring time, and an input/output interface (I/O interface).

Detail Description Paragraph:
[0032] The CVT controller 20 reads the shift lever position from the inhibitor

switch 23, the accelerator pedal stroke from the accelerator stroke sensor 24, the oil temperature of the transmission 10 from the oil temperature sensor 25, and signals from the primary pulley speed sensor 26, the secondary pulley speed sensor 27, the oil pressure sensor 28 and the vehicle-dynamics-control (VDC) unit 29. By reading this data, the speed ratio and the contact frictional force of the V belt 13 are controlled, and it is determined whether an abnormal reduction in oil pressure occurred as described later. The VDC unit 29, in order to prevent lateral instability of the vehicle, controls the engine 1, braking system and the oil pressure system.

Detail Description Paragraph:
[0034] Referring to the block diagram of FIG. 3, the abnormal oil pressure reduction determination of the CVT controller 20 will now be described. In FIG. 3, each section is an imaginary section showing a function performed by the microcomputer of the CVT controller 20.

Detail Description Paragraph:
[0035] A control region determination unit 211 determines whether or not the engine rotation speed and secondary pressure are in a region in which feedback control of secondary pressure is possible. Specifically, the control region determination unit 211 calculates a difference D1 of the real oil pressure of the secondary pulley and a target oil pressure for the secondary pulley (i.e. secondary oil pressure command value), and determines whether or not the secondary pressure is in a region where the secondary oil pressure command value can be attained. Herein, the case where feedback control of secondary pressure cannot be performed is for example the case that the engine rotation speed is low, or the case that the oil pressure sensor 28 has a fault. As the oil pump 34 which supplies secondary pressure is usually driven by the engine 1, if the engine rotation speed is lower than a predetermined rotation speed, the oil pump cannot generate sufficient oil pressure. Therefore, when the engine does not reach the predetermined rotation speed, feedback control of secondary pressure is not performed. When the oil pressure sensor 28 has a fault, a precise real oil pressure cannot be obtained for the secondary pressure, and a detection error may occur. Therefore, feedback control is not performed in this case, either. Hence, the control region determination unit 211 determines whether the vehicle is in a state where feedback control of the secondary pressure cannot be performed, based on signals corresponding to the engine rotation speed and the real secondary oil pressure.

Detail Description Paragraph:
[0036] An oil pressure control mode determination unit 212 determines whether or not an oil pressure control mode is an ordinary mode. Herein, the ordinary mode is a mode in which the oil pressure command values are set based on the input torque to the transmission 10 and speed ratio of the transmission 10. A non-ordinary mode is a mode in which the oil pressure command values are set regardless of the balance between the oil amount supplied from the pump 34 and the oil amount used, for example in the case where the oil temperature is in a very low temperature region, or the case where the operating range of the transmission system is changing. The very low temperature region may be a region below a predetermined temperature (for example, -30.degree. C.). In other words, if the temperature is very low, the viscosity of the oil is high, so the oil pressure is taken as the maximum pressure which can possibly be generated. Also, when the operating range of the transmission system is changing, in order to ensure the oil pressure required to engage the clutch of the forward/reverse change-over mechanism 3, the oil pressure (line pressure) supplied to the pulley is limited. As a result, the target oil pressure is not determined based on the input torque and speed ratio, and an abnormal oil pressure reduction in the oil pressure control mechanism 30 cannot be determined by the difference D1 between the secondary oil pressure command value and real secondary pressure. To detect this situation, the oil pressure control mode determination unit 212 determines whether or not the vehicle is in the aforesaid ordinary mode based on an oil temperature signal from the oil temperature

sensor 25 and a range signal Rs from the inhibitor switch 23.

Detail Description Paragraph:
[0037] A spin recovery correction determination unit 213 determines whether or not the VDC unit 29 is performing spin recovery correction. Spin recovery correction means that, when vehicle sideslip prevention control is being performed in order to prevent the vehicle from running unstably when the tires slip, the oil pressure is increased to a limit determined by the balance between the supply oil amount and used oil amount, and further the engine torque is limited. During spin recovery correction, when the dynamic frictional coefficient between the vehicle tires and road surface increases, a torque acts from the vehicle wheels on the transmission 1 in the reverse direction, and a correction must be performed for this reverse torque. Therefore, during spin recovery correction, since the extent of the torque input in the reverse direction is unknown, the oil pressure is increased to a limit and further the engine torque is limited. As the engine torque is limited, the engine rotation speed is suppressed low, and thereby the oil pressure which can be generated by the oil pump 34 is low. Even if the reduction of oil pressure is determined in this state, the real oil pressure of the secondary pulley cannot be increased to the secondary oil pressure command value, and thus the determination of abnormal oil pressure reduction will be incorrect. Therefore, the determination is not performed at this time. To avoid performing the determination of abnormal oil pressure reduction during spin recovery correction, by the spin recovery correction determination unit 213, it is determined whether or not spin recovery correction is being performed based on a control signal from the VDC unit 29 and a vehicle speed signal.

Detail Description Paragraph:
[0038] A brake SW determination unit 214 determines whether or not a brake switch 41 is OFF. Even if the brake switch 41 is ON, a torque is input from the engine to the transmission 1, and a torque is input from the vehicle wheels to the transmission 1 in the reverse direction, so a correction must be made for this reverse torque. When the brake switch 41 is ON, the torque input in the reverse direction is normally larger than the torque input from the engine. As a result, the input torque to the transmission 10 is corrected, taking into account the torque input in the reverse direction, and the target oil pressure (i.e. oil pressure command value) is set based on the corrected input torque. Due to this, the secondary oil pressure command value becomes sufficiently large. Also, when the brake switch 41 is ON, the engine rotation speed is suppressed low, so a fairly large oil pressure cannot be generated. However, the secondary oil pressure command value is high because of the correction for the reverse torque. If oil pressure reduction is determined in this state, since the real oil pressure of the secondary pulley cannot be increased to the secondary oil pressure command value, the oil pressure reduction will be incorrectly determined.

Detail Description Paragraph:
[0039] Therefore, when the brake switch 41 is ON, an oil pressure reduction determination is not performed. In order to avoid performing the oil pressure reduction determination when the brake switch 41 is ON, a signal is input from the brake switch 41, and ON/OFF of the brake switch 41 is determined in the brake SW determination unit 214.

Detail Description Paragraph:
[0040] In a shift range determination unit 215, it is determined whether or not the shift range position is in a position other than the N range position, based on a range signal Rs. When the shift range position is the N range position, the command value of the line pressure is set to the oil pressure which can really be generated (i.e. the oil pressure above a lower limit), and it is further set to a value lower than an upper limit below which oil pump noise is sufficiently low. Therefore, in this case also, there is a possibility that the real oil pressure for the secondary pulley cannot be increased to the secondary oil pressure command value, so it is

determined in the shift range determination unit 215 whether or not the shift range position is outside the N range position.

Detail Description Paragraph:
[0041] A re-determination prohibition state determination unit 216 determines whether or not re-determination of oil pressure reduction can be performed based on a signal from a re-determination prohibition timer 242, described later. Specifically, to verify that the oil pressure reduction is reproducible and to avoid incorrect determination, a re-determination is permitted by the re-determination prohibition state determination unit 216 after the unit 216 determines that a second predetermined time period has elapsed in the re-determination prohibition timer 242.

Detail Description Paragraph:
[0042] An oil pressure difference determination unit 221 determines whether or not the secondary oil pressure command value and the real secondary pressure effectively coincide. Specifically, if the oil pressure difference D1 between a secondary oil pressure command value issued to the pressure reduction valve 33 and the real secondary pressure of the oil pressure sensor 28 is less than a reference value, the real secondary pressure effectively coincides with the secondary oil pressure command value, so it is determined that an abnormal oil pressure reduction is absent. If the oil pressure difference D1 is more than the reference value, it is determined that an abnormal oil pressure is present. Hence, in the oil pressure determination unit 221, it is determined whether or not the real oil pressure of the secondary pulley has effectively reached the secondary oil pressure command value. Herein, the reference value of the pressure difference D1 between the secondary oil pressure command value and real secondary pressure is set taking account of the detection precision of the oil pressure sensor and variations in the performance of the oil pressure control mechanism 30.

Detail Description Paragraph:
[0043] A pressure comparing unit 222 determines whether or not the real oil pressure is less than a lower limiting oil pressure. The oil pump 34 cannot generate an oil pressure below the lower limiting oil pressure under the present operating conditions of the oil pressure control mechanism 30. Herein, the oil pump 34 is driven by the engine 1, so the lower limiting oil pressure depends mainly on the engine rotation speed. However, the lower limiting oil pressure is also affected by the oil temperature and variations (e.g. variations in initial performance or temporal variation in performance due to deterioration) in the condition of the components of the oil pressure control mechanism 30 (in particular, the oil pump). Therefore, the lower limiting oil pressure is computed also taking account of these factors. Thus, when the pressure is less than the lower limiting oil pressure, it is determined that there is a fault of some kind in the oil pressure control mechanism 30.

Detail Description Paragraph:
[0044] A running state determination unit 223 determines whether or not the vehicle is running steadily, based on the throttle opening and vehicle speed variation. The throttle opening is normally equivalent to an accelerator pedal stroke. Herein, the steady state means a state which is not a transient state. A transient state is the rapid acceleration state or rapid deceleration state of the vehicle. When the vehicle is in a transient state, there is a large deviation between the secondary oil pressure command value and real secondary pressure, and there is a high possibility of incorrect determination of the absence/existence of an abnormal oil pressure reduction. Therefore, in order to perform an oil pressure reduction determination only in the steady state, the running state determination unit 223 determines whether or not the vehicle is in a steady running state. Herein, when there is a throttle opening variation larger than about .+-.{fraction (0.5/8)}, it may determined that the vehicle is in a transient state. (Here, the maximum throttle opening is 8.) This is because even when the vehicle is running at a fixed

speed, the throttle opening normally fluctuates to this extent of .+-.{fraction (0.5/8)}.

Detail Description Paragraph:
[0045] A continuity determination unit 231 determines whether or not an abnormal drop of the oil pressure has continued for more than a first predetermined time period. This eliminates noise, and prevents incorrect determination of abnormal oil pressure reduction. The continuity determination unit 231 comprises a timer for measuring the duration of the abnormal oil pressure reduction.

Detail Description Paragraph:
[0046] When a state where the oil pressure difference D1 between the secondary oil pressure command value and real secondary pressure is larger than the reference value with the vehicle in a steady running state, and the real oil pressure is less than the lower limiting oil pressure, continues for more than the first predetermined time period, the continuity determination unit 231 finally determines that the oil pressure has dropped abnormally due to a fault in the oil pressure control mechanism 30.

Detail Description Paragraph:
[0047] A reproducibility determination counter 241 increases by unity when the continuity determination unit 231 determines an abnormal reduction of the oil pressure due to a fault in the oil pressure control mechanism 30. Specifically, the reproducibility determination counter 241 counts the number of occasions when the abnormal oil pressure reduction is determined in the continuity determination unit 231.

Detail Description Paragraph:
[0048] A re-determination prohibition timer 242 is a timer which prohibits re-determination within the second predetermined time period after the reproducibility determination counter 241 has increased by unity. After the second predetermined time period has elapsed, a re-determination prohibition state determination unit 216 permits re-determination. Hence, by re-determining abnormal oil pressure reduction after the second predetermined time period has elapsed, temporarily detected oil pressure reductions are eliminated, and abnormal oil pressure reductions due to a fault in the oil pressure control mechanism 30 are more reliably determined.

Detail Description Paragraph:
[0050] The flowchart of FIG. 4 shows the control routine executed by the CVT controller 20 in the abnormal oil pressure reduction determining device of the vehicle transmission according to this invention. This control routine is implemented as a program executed by a microcomputer.

Detail Description Paragraph:
[0051] In a Step S1, it is determined whether or not oil pressure reduction determination permission conditions are satisfied. When the oil pressure reduction determination permission conditions are satisfied, the determination permission flag is set to unity. When the oil pressure reduction determination permission conditions are not satisfied, the determination permission flag is set to zero. The details of a subroutine of the Step S1 will be described later.

Detail Description Paragraph:
[0052] In a Step S2, it is determined whether or not the determination permission flag is set to unity. If the determination permission flag is set to unity (i.e. the oil pressure reduction determining permission conditions are satisfied), the routine proceeds to a Step S3, and if the determination permission flag is set to zero, the routine proceeds to a Step S12.

Detail Description Paragraph:

[0053] In a Step S3, by the oil pressure difference determination unit 221, it is determined whether or not the difference D1 between the secondary oil pressure command value and real secondary pressure is equal to or more than a reference value. When the difference D1 is equal to or more than the reference value, the routine proceeds to a Step S4, and when the difference D1 is not equal to or more than the reference value, the routine proceeds to the Step S12.

Detail Description Paragraph:
[0054] In the Step S4, by the pressure comparing unit 222, it is determined whether or not the real oil pressure is less than the lower limiting oil pressure under the present running conditions. When it is less than the lower limiting oil pressure, the routine proceeds to a Step S5, and when it is equal to or more than the lower limiting oil pressure, the routine proceeds to the Step S12.

Detail Description Paragraph:
[0056] In a Step S6, it is determined that there has already been an abnormal oil pressure reduction, so the timer value for measuring the duration of the abnormal oil pressure reduction is decreased by unity.

Detail Description Paragraph:
[0057] In a Step S7, by the continuity determination unit 231, it is determined whether or not the abnormal oil pressure reduction has continued for a first predetermined time period or longer, i.e., it is determined whether or not the timer value for measuring the duration of the abnormal oil pressure reduction is zero. When the abnormal oil pressure reduction has continued for the first predetermined time period or longer, i.e. the timer value is zero, the routine proceeds to a Step S8, and when it has not continued for the first predetermined time period, the routine returns to the Step S1.

Detail Description Paragraph:
[0059] In the Step S10, it is determined that an abnormal oil pressure reduction occurred due to a fault in the oil pressure control mechanism 30, so by the abnormal reduction determination unit 251, the countermeasure control flag is set to unity.

Detail Description Paragraph:
[0064] In a Step S101, by the control region determination unit 211, it is determined whether or not the vehicle is in a state where feedback control of the secondary pressure is possible. If the vehicle is in a state where feedback control is possible, the routine proceeds to a Step S102, and if the vehicle is a state wherein feedback control is impossible, the routine proceeds to a Step S107. Specifically, it is determined whether the engine rotation speed is higher than a predetermined rotation speed, or whether there is a fault in the oil pressure sensor 28. For example, when the signal from the oil pressure sensor 28 is interrupted, it is determined that there is a fault in the oil pressure sensor 28.

Detail Description Paragraph:
[0065] In the Step S102, by the oil pressure control mode determination unit 212, it is determined whether or not the oil pressure control mode is the ordinary mode. In the case of the ordinary mode, the routine proceeds to a Step S103, and in the case of a non-ordinary mode, the routine proceeds to the Step S107. Specifically, it is determined whether the oil temperature is a very low temperature, or whether the operating range of the transmission system is changing, based on the range signal Rs.

Detail Description Paragraph:
[0069] In the Step S106, it is determined that an oil pressure reduction determination permission condition is satisfied, and the determination permission flag is set to unity. In the Step S107, it is determined that the oil pressure reduction determination permission condition is not satisfied, and the

determination permission flag is set to zero.

Detail Description Paragraph:
[0070] Next, referring to the graph of FIG. 6, the determination for the continuity of abnormal oil pressure reduction will be described.

Detail Description Paragraph:
[0071] As shown in FIG. 6A, at a time t1, if the pressure difference D1 between the secondary oil pressure command value and real secondary pressure is more than a reference value, it is determined that oil pressure reduction has occurred (Step S3). In this state, it is determined whether or not the vehicle is in the steady running state (Step S5), as shown in FIGS. 6B and 6C. In other words, it is determined whether or not the accelerator pedal stroke (TV0) and vehicle speed (Vsp) have remained within the permitted range continuously for the first predetermined time period or longer, taking the accelerator pedal stroke (TV0) and the vehicle speed (Vsp) at the time t1 as references. The permitted range of the accelerator pedal stroke (TV0) is a range centered on the accelerator pedal stroke (TV0) at the time t1, and is bounded by a permitted upper limit and permitted lower limit. The permitted range of the vehicle speed (Vsp) is a range centered on the vehicle speed (Vsp) at the time t1, and is also bounded by a permitted upper limit and permitted lower limit.

Detail Description Paragraph:
[0073] Next, in FIG. 6D, if the timer value is zero at a time t3, it is determined that there was a fault in the oil pressure control mechanism 30. In this case, the reproducibility determination counter is incremented by unity (Step S8).

Detail Description Paragraph:
[0074] Referring to the graph of FIG. 7, the determination of abnormal oil pressure reduction will now be described. In FIG. 7, the horizontal axis is the time axis. The vertical axis with an arbitrary unit shows oil pressure, vehicle speed (Vsp), accelerator pedal stroke (TV0) and engine rotation speed (EngRev).

Detail Description Paragraph:
[0075] In FIG. 7, the process of the Step S101 determines a secondary feedback control permission region wherein the engine rotation speed is higher than the predetermined rotation speed and the oil pressure sensor 28 does not have a fault. The process of the Step S102 determines an ordinary mode wherein the operating range of the transmission is not changing and the oil temperature is not a very low temperature. The process of the Step S103 determines that spin recovery correction is not being performed. The process of the Step S104 determines that the brake switch 41 switches from ON to OFF at a time t0. The process of the Step S105 determines that the shift lever position is the D range position. In the above situation, oil pressure reduction determination conditions are satisfied (Step S106). Hence, as shown by the shading in FIG. 7, the oil pressure difference D1 (secondary oil pressure command value--real secondary oil pressure) at the time t1 is more than a reference value A1 (Step S2). In the process of the Step S4, the real oil pressure is less than the lower limiting oil pressure. In the case of the steady running state wherein variations of the accelerator pedal stroke (TV0) and the vehicle speed (Vsp) are small (Step S5), it is determined in the Step S6 that there is an abnormal oil pressure reduction due to a fault in the oil pressure control mechanism 30, and the continuation time (duration) of the abnormal oil pressure reduction is measured from the time t1. If this abnormal oil pressure reduction continues beyond the time t3 for a period longer than the first predetermined time period t4 (Step S7), an abnormal oil pressure is determined for the first time, and in a Step S8, the reproducibility determination counter is incremented by unity.

Detail Description Paragraph:
[0076] Referring to the graph of FIG. 8, the determination of reproducibility of

abnormal oil pressure reduction will now be described. The graph of FIG. 8 is a graph which enlarges FIG. 7 with respect to time.

Detail Description Paragraph:
[0077] When the second predetermined time period has elapsed (Step S11) since the last increment of the reproducibility determination counter (Step S8), it is again determined whether or not there is a fault in the oil pressure control mechanism 30 as described above (Steps 1-7). As shown by the shading in FIG. 8, after a second predetermined time period t5 has elapsed from the time t3, during an interval from a time t6 to the time t7, it is again determined whether there was a fault in the oil pressure system. When a fault is determined in the oil pressure system 30 in this way, the reproducibility determination counter is incremented by unity in the Step S8. In the determination of the Step S9, if the value of the reproducibility determination counter is equal to or more than a predetermined counter value, it can be determined for certain that there is a fault in the oil pressure control mechanism 30, and that the oil pressure has abnormally decreased due to this reason. This predetermined counter value of the reproducibility determination counter may conveniently be determined based on system reliability and the required precision, and may be 2, 3 or a higher number.

Detail Description Paragraph:
[0078] The effect of this embodiment will now be described. If the state wherein the pressure difference D1 between the command pressure and real pressure continues for the first predetermined time period t4 or longer, it is determined that there is an abnormal pressure reduction. As a result, noise is eliminated, and an incorrect determination is prevented. Also, if the real oil pressure is less than the lower limiting oil pressure which naturally arises in the vehicle running state, it is determined that there is an abnormal oil pressure reduction. Consequently, a precise determination can be made.

Detail Description Paragraph:
[0079] By providing the reproducibility determination counter, it is determined whether or not an abnormal reduction has occurred on plural occasions. As a result, incorrect determination is prevented, and an abnormal oil pressure reduction due to a fault in the oil pressure control mechanism can be more precisely determined. By providing the re-determination prohibition timer, a re-determination is performed after the second predetermined time period t5 has elapsed. Due to this, temporary reductions are eliminated, and an abnormal oil pressure reduction due to a fault in the oil pressure control mechanism 30 can be more precisely determined.

Detail Description Paragraph:
[0080] When the secondary pressure cannot be feedback controlled (e.g., when the engine rotation speed is low or there is a fault in the oil pressure sensor 28), when the oil pressure control mode is not the ordinary mode (e.g., when the oil temperature is a very low temperature, or the operating range of the transmission system is changing), when spin recovery correction is being performed, when the brake switch 41 is ON, when the selected range is a range outside the N range, or when the vehicle running state is the transient state (e.g., rapid acceleration or rapid deceleration), oil pressure reduction determination is inhibited. As a result, incorrect determination of oil pressure reduction due to a fault in the oil pressure control mechanism 30 is definitively prevented.

Detail Description Paragraph:
[0083] In the above embodiment, the case is described where the CVT speed change part is controlled by oil pressure, but also in the case of an abnormal reduction of oil pressure in the mechanism which controls the forward/reverse change-over mechanism by oil pressure, abnormal reduction of the oil pressure can be determined by an identical construction. Further, although in the above embodiment, a difference D1 between the real oil pressure of the secondary pulley and the oil pressure command value for the secondary pulley is calculated, a difference D1

between the real oil pressure of the first pulley and the oil pressure command value for the first pulley may be calculated to detect an abnormal reduction of oil pressure in the oil pressure control mechanism 30. Also, this invention may likewise be applied to the case where the transmission is a stepwise transmission having planetary gears.

CLAIMS:

1. An abnormal oil pressure reduction determination device for use with a transmission of a vehicle, the transmission having an oil pressure control mechanism which performs speed change control using oil pressure, the abnormal oil pressure reduction determination device comprising: an oil pressure sensor which detects a real oil pressure, a sensor which detects a vehicle running state, and a controller which sets an oil pressure command value for the oil pressure control mechanism, the controller comprising a microcomputer, wherein: the controller functions to: compute a lower limiting oil pressure which is possible in the vehicle running state, compare the real oil pressure with the lower limiting oil pressure, compare the real oil pressure with the oil pressure command value, and when the real oil pressure is less than the lower limiting oil pressure and when a pressure difference between the real oil pressure and oil pressure command value exceeds a reference value, determine that there is an abnormal oil pressure reduction due to a fault in the oil pressure control mechanism.

2. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the controller functions to measure a time, and when the pressure difference between the oil pressure command value and real oil pressure continuously exceeds a reference value for a first predetermined time period or longer, functions to determine that there is an abnormal oil pressure reduction.

3. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the controller functions to count the number of occasions when the pressure difference between the oil pressure command value and real oil pressure continuously exceeded the reference value for the first predetermined time period or longer, and when the number of occasions is equal to or more than a predetermined count value, functions to determine that there is an abnormal oil pressure reduction.

4. The abnormal oil pressure reduction determining device as defined in claim 3, wherein the controller further functions to increase the count, only when the situation where the pressure difference between the oil pressure command value and real oil pressure continuously exceeded the reference value for the first predetermined time period or longer, occurred after a second predetermined time has elapsed since a last increment of the count.

5. The abnormal oil pressure reduction determining device as defined in claim 1, further comprising a sensor which detects a rotation speed of an engine of the vehicle, wherein the controller further functions to inhibit the determination of the presence of an abnormal oil pressure reduction when the rotation speed of the engine is less than a predetermined rotation speed.

6. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the controller further functions to inhibit the determination of the presence of an abnormal oil pressure reduction when there is a fault in the oil pressure sensor.

7. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the vehicle further comprises a shift lever and a sensor which detects the shift lever position, and generates a corresponding range signal, and wherein the controller further functions to: determine whether or not an operating range of the transmission is changing based on the range signal, and when the operating range of

the transmission is changing, functions to inhibit the determination of the presence of an abnormal oil pressure reduction.

8. The abnormal oil pressure reduction determining device as defined in claim 1, further comprising a sensor which detects an oil temperature, wherein the controller further functions to inhibit the determination of the presence of an abnormal oil pressure reduction when the oil temperature is less than the predetermined oil temperature.

9. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the vehicle further comprises a vehicle dynamics control unit which performs spin recovery correction to prevent sideslip of the vehicle, and wherein the controller further functions to inhibit the determination of the presence of an abnormal oil pressure reduction when the spin recovery correction is being performed.

10. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the vehicle further comprises a brake switch which detects ON/OFF of the brake, and wherein the controller further functions to inhibit the determination of the presence of an abnormal oil pressure reduction when the brake switch is ON.

11. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the vehicle further comprises a shift lever, and a sensor which detects a shift lever position and generates a corresponding range signal, and wherein the controller further functions to inhibit the determination of the presence of an abnormal oil pressure reduction when the range signal is a neutral range signal.

12. The abnormal oil pressure reduction determining device as defined in claim 1, further comprising an accelerator pedal stroke sensor which detects an accelerator pedal stroke and a sensor which detects vehicle speed, wherein the controller further functions to determine the vehicle running state based on the accelerator pedal stroke and vehicle speed, and when the vehicle running state is a rapid acceleration state or rapid deceleration state, functions to inhibit the determination of the presence of an abnormal oil pressure reduction.

13. The abnormal oil pressure reduction determining device as defined in claim 1, wherein the oil pressure control mechanism comprises a pump driven by a rotation of an engine of the vehicle, and wherein a sensor which detects the vehicle running state comprises a sensor which detects a rotation speed of the engine, and wherein the controller further functions to: compute the lower limiting oil pressure based on the rotation speed of the engine.

14. An abnormal oil pressure reduction determination device for use with a transmission of a vehicle, the transmission having an oil pressure control mechanism which performs speed change control using oil pressure, the abnormal oil pressure reduction determination device comprising: means for detecting a real oil pressure, means for detecting a vehicle running state, means for setting an oil pressure command value for the oil pressure control mechanism, means for computing a lower limiting oil pressure which is possible in the vehicle running state, means for comparing the real oil pressure with the lower limiting oil pressure, means for comparing the real oil pressure with the oil pressure command value, and means for determining that there is an abnormal oil pressure reduction due to a fault in the oil pressure control mechanism when the real oil pressure is less than the lower limiting oil pressure and when a pressure difference between the real oil pressure and oil pressure command value exceeds a reference value.

15. An abnormal oil pressure reduction determination method for use with a transmission of a vehicle, the transmission having an oil pressure control mechanism which performs speed change control using oil pressure, the abnormal oil pressure reduction determination method comprising the steps of: detecting a real

oil pressure, detecting a vehicle running state, setting an oil pressure command value for the oil pressure control mechanism, computing a lower limiting oil pressure which is possible in the vehicle running state, comparing the real oil pressure with the lower limiting oil pressure, comparing the real oil pressure with the oil pressure command value, and determining that there is an abnormal oil pressure reduction due to a fault in the oil pressure control mechanism when the real oil pressure is less than the lower limiting oil pressure and when a pressure difference between the real oil pressure and oil pressure command value exceeds a reference value.

Previous Doc Next Doc Go to Doc#

Refine Search

10/676266

Your wildcard search against 10000 terms has yielded the results below.

Your result set for the last L# is incomplete.

The probable cause is use of unlimited truncation. Revise your search strategy to use limited truncation.

Search Results -

Terms	Documents
L15 and (pressur$ near5 ((exceed$ or over$) with (threshold$ or referen$)))	2

Database: US Pre-Grant Publication Full-Text Database; US Patents Full-Text Database; US OCR Full-Text Database; EPO Abstracts Database; JPO Abstracts Database; Derwent World Patents Index; IBM Technical Disclosure Bulletins

Search: L17

Refine Search | Recall Text | Clear | Interrupt

Search History

DATE: Monday, July 03, 2006 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR		
	L15 and (pressur$ near5 ((exceed$ or over$) with		

L17	(threshold$ or referen$)))	2	L17
L16	L15 and (pressur$ near2 ((exceed$ or over$) with (threshold$ or referen$)))	1	L16
L15	l13 or L14	226	L15
L14	L12 and @pd<=20021004	187	L14
L13	L12 and @ad<=20021004	219	L13
L12	L3 and ((comput$ or calculat$ or determin$ or decid$ or consider$) near5 (oil$ near5 pressur$))	303	L12
L11	L10 and (pressur$ near2 (exceed$ with (threshold$ or referen$)))	1	L11
L10	l8 or L9	174	L10
L9	L7 and @pd<=20021004	139	L9
L8	L7 and @ad<=20021004	169	L8
L7	L3 and ((comput$ or calculat$ or determin$ or decid$ or consider$) near3 (oil$ near3 pressur$))	235	L7
L6	L4 and (exceed$ with (threshold$ or referen$))	9	L6
L5	L4 and (exceed$ with referen$)	4	L5
L4	L3 and (pressur$ with abnormal$)	66	L4
L3	(oil$ near2 pressur$) with vehicle with transmission$	1844	L3
DB=USPT; THES=ASSIGNEE; PLUR=YES; OP=OR			
L2	"oil pressur" with abnormal$	0	L2
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; THES=ASSIGNEE; PLUR=YES; OP=OR			
L1	"oil pressur$" with abnormal$	1	L1

END OF SEARCH HISTORY

First Hit Previous Doc Next Doc Go to Doc#

End of Result Set

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L11: Entry 1 of 1 File: JPAB Apr 22, 2004

PUB-NO: JP02004125104A
DOCUMENT-IDENTIFIER: JP 2004125104 A
TITLE: APPARATUS FOR JUDGING ABNORMAL DECREASE IN OIL PRESSURE OF TRANSMISSION FOR VEHICLE

PUBN-DATE: April 22, 2004

INVENTOR-INFORMATION:

NAME	COUNTRY
KANG, JIHOON	
KAWAMURA, YASUTAKA	
SHIMANAKA, SHIGEKI	
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OKAHARA, HIROBUMI	

ASSIGNEE-INFORMATION:

NAME	COUNTRY
JATCO LTD	

APPL-NO: JP2002291891
APPL-DATE: October 4, 2002

INT-CL (IPC): F16 H 61/12

ABSTRACT:

PROBLEM TO BE SOLVED: To surely judge conditions even if the oil pressure of the transmission should decrease by some sort of causes.

SOLUTION: An apparatus comprises the transmission 10 for vehicles having oil pressure responsive members 11, 12 for controlling a shift; an actual oil pressure detection means 28 for detecting the actual pressure of the oil pressure; an instructed pressure setting means 221 for setting the instructed pressure of the oil pressure; a lower limit oil pressure calculation means 222 for calculating the lower-limit oil pressure that can be generated at that time from the operation state; and an oil pressure abnormal decrease judging means 251 for judging that the oil pressure has decreased abnormally when the actual pressure goes lower than the lower-limit oil pressure and the pressure difference between the actual pressure and the instructed pressure exceeds a reference value.

Previous Doc Next Doc Go to Doc#

L17: Entry 1 of 2 File: USPT Sep 1, 1998

US-PAT-NO: 5800308
DOCUMENT-IDENTIFIER: US 5800308 A
** See image for Certificate of Correction **

TITLE: Pressure control of hydraulic servos while in gear at a stopped neutral state

DATE-ISSUED: September 1, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Tsutsui; Hiroshi	Nishio			JP
Tsukamoto; Kazumasa	Toyota			JP
Hayabuchi; Masahiro	Anjo			JP
Nishida; Masaaki	Anjo			JP
Yamamoto; Yoshihisa	Nishio			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Aisin AW Co., Ltd.				JP	03

APPL-NO: 08/644444 [PALM]
DATE FILED: May 13, 1996

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	7-115013	May 12, 1995
JP	7-224310	August 31, 1995

INT-CL-ISSUED: [06] F16 H 61/20

US-CL-ISSUED: 477/116; 477/117, 477/156
US-CL-CURRENT: 477/116; ~~477/117~~, 477/156

FIELD-OF-CLASSIFICATION-SEARCH: 477/114, 477/116, 477/117, 477/143, 477/156, 477/158
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

	PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
☐	4982622	January 1991	Yamamoto et al.	477/117
☐	5272630	December 1993	Brown et al.	364/424.1
☐	5301572	April 1994	Tanaka et al.	477/116
☐	5307727	May 1994	Berger et al.	91/29
☐	5343782	September 1994	Jamzadeh	477/156
☐	5363724	November 1994	Asahara et al.	477/143
☐	5527236	June 1996	Kimura et al.	477/156 X
☐	5558599	September 1996	Tsukamoto et al.	477/117 X
☐	5586954	December 1996	Iwata et al.	477/114 X

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
0482689	April 1992	EP	
0588443	March 1994	EP	
220260	November 1985	JP	

ART-UNIT: 352

PRIMARY-EXAMINER: Ta; Khoi Q.

ATTY-AGENT-FIRM: Lorusso & Loud

ABSTRACT:

A control system for an automatic transmission operates a clutch for disengaging a transmission mechanism when a vehicle is stopped and idling with the brake pedal depressed while the gear shift is in a forward gear. The clutch is maintained at a drag state (friction elements disengaged but oil causing some torque transmission) bordering a slip state (friction elements engaged) When a neutral control is started, the clutch is released until the retraction of the piston of the hydraulic servo is started. When the rate of change in a rotational difference does not exceeds a reference rate of change even after a set time has elapsed, booster means of specific release state holding means decides that the clutch is in a drag region, and raises an oil pressure to be fed to the hydraulic servo, by a set pressure. On the other hand, when the rate of change exceeds the reference rate and the rotational difference increases, irrespective of the lapse of a set time, the first pressure reducing means of the specific release state holding means decides that the clutch is in a slip region, and lowers the oil pressure to be fed to the hydraulic servo, by a set pressure. As a result, the clutch is always held in a state which is immediately before the transfer from the drag region to the slip region.

5 Claims, 23 Drawing figures

Previous Doc Next Doc Go to Doc#

No cal.

L17: Entry 1 of 2 File: USPT Sep 1, 1998

DOCUMENT-IDENTIFIER: US 5800308 A
** See image for Certificate of Correction **
TITLE: Pressure control of hydraulic servos while in gear at a stopped neutral state

Abstract Text (1):
A control system for an automatic transmission operates a clutch for disengaging a transmission mechanism when a vehicle is stopped and idling with the brake pedal depressed while the gear shift is in a forward gear. The clutch is maintained at a drag state (friction elements disengaged but oil causing some torque transmission) bordering a slip state (friction elements engaged) When a neutral control is started, the clutch is released until the retraction of the piston of the hydraulic servo is started. When the rate of change in a rotational difference does not exceeds a reference rate of change even after a set time has elapsed, booster means of specific release state holding means decides that the clutch is in a drag region, and raises an oil pressure to be fed to the hydraulic servo, by a set pressure. On the other hand, when the rate of change exceeds the reference rate and the rotational difference increases, irrespective of the lapse of a set time, the first pressure reducing means of the specific release state holding means decides that the clutch is in a slip region, and lowers the oil pressure to be fed to the hydraulic servo, by a set pressure. As a result, the clutch is always held in a state which is immediately before the transfer from the drag region to the slip region.

Application Filing Date (1):
19960513

DATE ISSUED (1):
19980901

Brief Summary Text (11):
According to a first aspect of the present invention, there is provided a control system for an automatic transmission having a speed change unit with a transmission mechanism. The control system includes a fluid transmission unit for transmitting rotation of an engine to the speed change unit; a clutch adapted to be applied when a forward running range is selected to transmit the rotation of the fluid transmission unit to the transmission mechanism of the speed change unit; a hydraulic servo for applying/releasing the clutch; stop state detecting facilities for detecting a vehicle stop state which is defined by (a) a forward running range being selected, (b) a throttle opening being fully closed, (c) a brake pedal being depressed, and (d) a vehicle speed being substantially zero; input speed detecting facilities for detecting the input rotational speed of the fluid transmission unit; output speed detecting facilities for detecting the output rotational speed of the fluid transmission unit; hydraulic control facilities for controlling oil pressure fed to the hydraulic servo; and a control unit. The control unit includes calculation facilities for calculating the rotational difference between the input speed and the output speed; release facilities for releasing the clutch by lowering the oil pressure fed to the hydraulic servo until the retraction of the piston of the hydraulic servo is started when the vehicle stop state is detected; and

specific release state holding facilities for holding the clutch in a released state immediately before the transfer of the clutch from a drag region (non-engaged state) to a slip region (engaged state) until the vehicle stop state is not detected after the release of the clutch. The specific release state holding facilities includes booster facilities for raising the oil pressure fed to the hydraulic servo by a set pressure unless a rate of change of the rotational difference exceeds a reference rate of change even after lapse of a set time period; and first pressure reducing facilities for lowering the oil pressure fed to the hydraulic servo by a set pressure if the rate of change exceeds the reference rate irrespective of the lapse of the set time period and if the rotational difference increases.

Brief Summary Text (24):
According to a further aspect of the present invention, this release facilities includes second pressure reducing facilities for reducing the oil pressure fed to the hydraulic servo, by the set pressure if the rate of change exceeds the reference rate of change before the set time elapses and if the rotational difference decreases.

Detailed Description Text (3):
Additionally, reference numeral 41 designates an automatic transmission control system; numeral 49 designates an engine RPM sensor acting as input RPM detecting means for detecting the input rotational speed of the torque converter 12; numeral 47 designates an RPM sensor acting as output RPM detecting means for detecting the output rotational speed of the torque converter 12; and numeral 101 designates stop state detecting means for detecting a vehicle stop state. The vehicle stop state is defined as the state satisfying the conditions: (a) a forward running range is selected, (b) a throttle opening .theta. is fully closed, (c) the brake pedal is depressed, and (d) the vehicle speed is substantially zero. The automatic transmission control system 41 is provided with: calculation means 102 for calculating the rotational difference between the input RPM and the output RPM; release means 104 for releasing the first clutch C1 by lowering the oil pressure fed to the hydraulic servo C-1 until the retraction of the piston of the hydraulic servo C-1 is started while the vehicle stop state is detected; and specific release state holding means 105 for holding the first clutch C1 in a state immediately before the transfer from a drag region to a slip region until an absence of the vehicle stop state is detected.

Detailed Description Text (4):
The specific release state holding means 105 is equipped with booster means 107 for boosting the oil pressure fed to the hydraulic servo C-1, by a set pressure unless the rate of change of the aforementioned rotational difference exceeds a reference rate even after lapse of a set time period, and first pressure reducing means 108 for lowering the oil pressure fed to the hydraulic servo C-1, by a set pressure if the change of rate exceeds the reference rate irrespective of the lapse of the set time period and if the rotational difference increases.

Detailed Description Text (47):
For this, the engine RPM N.sub.E corresponding to the input torque is determined to output the C-1 oil pressure P.sub.C1 corresponding to the engine RPM N.sub.E, and the C-1 oil pressure P.sub.C1 is gradually lowered.

Detailed Description Text (80):
Noting that the rate of change .rho. is different in the drag region and in the slip region, standard rates of change .rho..sub.1 and .rho..sub.2 in the drag region and in the slip region when the C-1 oil pressure P.sub.C1 is raised are determined to suitably select an intermediate value between the two rates of change .rho..sub.1 and .rho..sub.2, and this intermediate value is set as a reference rate of change .rho..sub.REF.

Detailed Description Text (118):
Step S2-12: It is decided whether or not the oil pressure control flag F is ON, that is, whether or not the C-1 oil pressure P.sub.C1 is raised at the instant of elapse of the previous sampling time T.sub.SAM. The routine advances to Step S2-13, if the oil pressure control flag F is ON, but to Step S2-16 if the oil pressure control flag F is OFF.

CLAIMS:

1. A control system for an automatic transmission having a speed change unit with a transmission mechanism, the control system comprising: a fluid transmission unit for transmitting rotation of an engine to the speed change unit; a clutch adapted to be applied when a forward running range is selected to transmit the rotation of said fluid transmission unit to the transmission mechanism of said speed change unit; a hydraulic servo for applying/releasing said clutch; stop state detecting means for detecting a vehicle stop state which is defined by (a) a forward running range being selected, (b) a throttle opening being fully closed, (c) a brake pedal being depressed, and (d) a vehicle speed being substantially zero; input speed detecting means for detecting the input rotational speed of said fluid transmission unit; output speed detecting means for detecting the output rotational speed of said fluid transmission unit; hydraulic control means for controlling oil pressure fed to said hydraulic servo; and a control unit, wherein said control unit includes: calculation means for calculating the rotational difference between said input speed and said output speed; release means for releasing said clutch by lowering the oil pressure fed to said hydraulic servo until the retraction of the piston of said hydraulic servo is started when said vehicle stop state is detected; and specific release state holding means for holding the clutch in a released state immediately before the transfer of said clutch from a drag region to a slip region until said vehicle stop state is not detected after the release of said clutch, and wherein said specific release state holding means includes: booster means for raising the oil pressure fed to said hydraulic servo by a set pressure unless a rate of change of said rotational difference exceeds a reference rate of change even after lapse of a set time period; and first pressure reducing means for lowering the oil pressure fed to said hydraulic servo by a set pressure if said rate of change exceeds the reference rate irrespective of the lapse of said set time period and if the rotational difference increases.

4. A control system for an automatic transmission according to claim 1, wherein said release means includes second pressure reducing means for reducing the oil pressure fed to said hydraulic servo by said set pressure if said rate of change exceeds the reference rate of change while said rotational difference decreases until said set time elapses.

Previous Doc Next Doc Go to Doc#